Image AF/2877

Practiti n r' D cket No. 712-002.104/CC-0166 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Michael A. Davis et al.
Application No.: 09 /703,823 Group No.: 2877
Filed: November 1, 2000 Examiner: Michael A. Lyons
For: **Official System Featuring Chirped Bragg Grating Etalon For Providing Precise Reference Wavelengths**

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P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION—37 C.F.R. § 1.192)

NOTE: The phrase "the date on which" an "appeal was taken" in 35 U.S.C. 154(b)(1)(A)(ii) (which provides an adjustment of patent term if there is a delay on the part of the Office to respond within 4 months after an "appeal was taken") means the date on which an appeal brief under § 1.192 (and not a notice of appeal) was filed. Compliance with § 1.192 requires that: 1. the appeal brief fee (§ 1.17(c)) be paid (§ 1.192(a)); and 2.the appeal brief complies with § 1.192(c)(1) through (c)(9). See Notice of September 18, 2000, 65 Fed. Reg. 56366, 56385-56387 (Comment 38).

1. Transmitted herewith, in triplicate, is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on December 10, 2003.

NOTE: "Appellant must, within two months from the date of the notice of appeal under § 1.191 or within the time allowed for reply to the action from which the appeal was taken, if such time is later, file a brief in triplicate. . . " 37 C.F.R. § 1.192(a) (emphasis added).

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10*
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37 C.F.R. § 1.8(a)

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37 C.F.R. § 1.10 *

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☐ facsimile transmitted to the Patent and Trademark Office, (703) ____-______.

Debra A. Pongetti
Signature

Date: February 10, 2004

Debra A. Pongetti
(type or print name of person certifying)

* *Only the date of filing (§ 1.6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1.703(f). Consider "Express Mail Post Office to Addressee" (§ 1.10) or facsimile transmission (§ 1.6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.*

2. STATUS OF APPLICANT

This application is on behalf of

☒ other than a small entity.

☐ a small entity.

A statement:

☐ is attached.

☐ was already filed.

3. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 C.F.R. § 1.17(c), the fee for filing the Appeal Brief is:

☐	small entity	$165.00
☒	other than a small entity	$330.00

Appeal Brief fee due $ 330.00

4. EXTENSION OF TERM

NOTE: 37 C.F.R. § 1.704(b) ". . .an applicant shall be deemed to have failed to engage in reasonable efforts to conclude processing or examination of an application for the cumulative total of any periods of time in excess of three months that are taken to reply to any notice or action by the Office making any rejection, objection, argument, or other request, measuring such three-month period from the date the notice or action was mailed or given to the applicant, in which case the period of adjustment set forth in § 1.703 shall be reduced by the number of days, if any, beginning on the day after the date that is three months after the date of mailing or transmission of the Office communication notifying the applicant of the rejection, objection, argument, or other request and ending on the date the reply was filed. The period, or shortened statutory period, for reply that is set in the Office action or notice has no effect on the three-month period set forth in this paragraph."

NOTE: The time periods set forth in 37 C.F.R. § 1.192(a) are subject to the provision of § 1.136 for patent applications. 37 C.F.R. § 1.191(d). See also Notice of November 5, 1985 (1060 O.G. 27).

NOTE: As the two-month period set in § 1.192(a) for filing an appeal brief is not subject to the six-month maximum period specified in 35 U.S.C. § 133, the period for filing an appeal brief may be extended up to seven months. 62 Fed. Reg. 53,131, at 53,156; 1203 O.G. 63, at 84 (Oct. 10, 1997).

The proceedings herein are for a patent application and the provisions of 37 C.F.R. § 1.136 apply.

(complete (a) or (b), as applicable)

(a) ☐ Applicant petitions for an extension of time under 37 C.F.R. § 1.136 (fees: 37 C.F.R. § 1.17(a)(1)-(5)) for the total number of months checked below:

	Extension (months)	Fee for other than small entity	Fee for small entity
☐	one month	$ 110.00	$ 55.00
☐	two months	$ 420.00	$ 210.00
☐	three months	$ 950.00	$ 475.00
☐	four months	$ 1,480.00	$ 740.00
☐	five months	$ 2,010.00	$ 1,005.00

Fee: $________

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

☐ An extension for ______ months has already been secured, and the fee paid therefor of $______________ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $______________

or

(b) ☒ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

5. TOTAL FEE DUE

The total fee due is:

Appeal brief fee $ 330.00

Extension fee (if any) $ N/A

TOTAL FEE DUE $ 330.00

6. FEE PAYMENT

☒ Attached is a ☒ check ☐ money order in the amount of $ 330.00

☐ Authorization is hereby made to charge the amount of $______________

☐ to Deposit Account No. ______________

☐ to Credit card as shown on the attached credit card information authorization form PTO-2038.

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☐ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this paper is attached.

7. FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to change the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986, *1065 O.G. 31-33.*

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SIGNATURE OF PRACTITIONER

Date:

William J. Barber

(type or print name of practitioner)

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PATENT
File No.: 712-002-104/CC-0166

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Re application of: Michael A. Davis et al.

Serial No.: 09/703,823 : Examiner: Michael A. Lyons

Filed: November 1, 2000 : Group Art Unit: 2877

For: OPTICAL SYSTEM FEATURING CHIRPED BRAGG GRATING ETALON FOR PROVIDING PRECISE REFERENCE WAVELENGTHS

MAIL STOP APPEAL BRIEFS &NDASH; PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

BRIEF FOR APPELLANTS

Sir:

This is an appeal from an Official Action mailed August 7, 2003, made final, including an Advisory Action mailed October 28, 2003.[1]

A Notice of Appeal was mailed on December 8, 2003 with a return receipt postcard. The Patent Office stamped and mailed the return receipt postcard back to applicants on December 10, 2003.

This Brief is being filed in triplicate with a fee in the amount of $330.00 in accordance with 37 CFR §1.17(c).

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[1] I hereby certify that this correspondence is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner for Patents, Alexandria, VA 22313-1450.

Debra A. Pongetti
Debra A. Pongetti

February 10, 2004
Date

I. THE REAL PARTY IN INTEREST

The real party in interest is CiDRA Corporation, of Wallingford, Connecticut, a corporation of the State of Delaware, doing business at 50 Barnes Park North, Wallingford, CT 06492.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

III. STATUS OF CLAIMS

Independent claims 1 - 20 are pending, stand rejected, and are being appealed.

IV. STATUS OF AMENDMENTS

No amendment was filed subsequent to the August 7th final rejection.

V. SUMMARY OF THE INVENTION

1. The Problem In The Art

Pages 1-2 of the patent application set forth the problem in the art being addressed by the claimed invention. In summary, the use of an etalon formed by broadband fiber Bragg grating pairs as shown in Figure 1 of the patent application results in a very limited set of resonant frequencies, as described in the patent application on page 2, line 20, through page 3, line 3. For example, if a resonant optical frequency is outside a very limited region, the light will pass through the fiber Bragg grating etalon cavity unaffected. For a set of reference optical frequencies, the unaffected light is most undesirable and would merely result in the provision of a very limited spectrum of optical reference signals. The use of a multiplicity of etalons formed from a series of broadband fiber Bragg grating pairs in order to overcome this problem raises a whole different set of problems, including issues related to the differing temperature sensitivities of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs.

2. The Claimed Solution

The inventors recognized the aforementioned problem in the art and provided a solution to the same. To solve this problem, the inventors designed an optical system featuring a chirped Bragg grating etalon that responds to the broadband optical

signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. The precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20 (See also dependent claim 4).

In effect, the whole thrust of the claimed invention is to use a broadband source in combination with a chirped Bragg grating etalon in order to provide a precise set of optical reference signals having a broad spectrum of frequencies of interest. As a person skilled in the art would appreciate, the use of the chirped Bragg grating etalon to provide the desired series of peaks covering most of the source spectral width of the broadband source substantially eliminates the differing temperature sensitivities problem that might otherwise occur with the use of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs like that of the prior art shown in Figure 1 of the patent application.

VI. ISSUE

The following issue will be addressed in the Argument:

The non-obviousness of claims 1-20 over Kringlebotn (United States Patent No. 6,097,487) in view of Farhadiroushan (United States Patent No. 5,754,293).[2]

VII. GROUPING OF THE CLAIMS

Claims 1, 4 and 20 are argued separately, and claims 2-3 and 5-19 stand or fall in relation to claim 1.

VIII. ARGUMENTS

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kringlebotn (United States Patent No. 6,097,487) in view of Farhadiroushan (United States Patent No. 5,754,293).[3]

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[2] The proposed combination also effectively include Galvanauskas et al. (United States Patent No. 5,499,134), which is being cited and relied on for disclosing chirped Bragg gratings.

[3] See footnote 2 re Galvanauskas et al..

The Traversal

It is respectfully submitted that the proposed combination of Kringlebotn in view of Farhadiroushan does not teach or suggest an optical system featuring a chirped Bragg grating etalon that responds to a broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. Moreover, it is respectfully submitted that the prior art does not suggest why one of ordinary skill in the art would be motivated first to combine features of Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device, then further modify the proposed combination by substituting Galvanauskas et al.' chirped Bragg gratings for Farhadiroushan's non-chirped inline fiber Bragg grating pairs, in order to end up with the claimed optical system for providing a precise set of reference signals, especially to solve the problem in the art being addressed by the inventors related to the use of broadband fiber Bragg grating pairs for providing such precise reference signals. None of the cited references even recognize the problem being solved by the inventors or suggest a solution thereto.

In particular, Kringlebotn discloses a wavelength measurement device for measuring Bragg grating wavelengths of several multiplexed FBGs, as described in column 4, line 37, to column 5, line 9. The wavelength measurement device includes a

broadband source 1 and tunable F-P filter 2 for providing a tunable broadband signal to a directional coupler 4 having two optical fibers attached thereto. One optical fiber has fiber Bragg gratings 6 having wavelengths λ_1, λ_2, λ_3, while the other optical fiber has at least one fiber Bragg grating 5 with a known wavelength having wavelengths λ_{ref}, and other fiber Bragg gratings λ_4, λ_5. In operation, the reflected light from the FBGs, occurring in time when the wavelength of the narrowband filter source light matches the Bragg wavelengths of the FBGs, is directed through a directional coupler 4 onto a detector 7 which converts the optical signal to an electrical pulse train as illustrated, with each pulse representing the individual Bragg wavelengths of the FBGs with one pulse representing λ_{ref}.

It is respectfully submitted that Kringlebotn does not teach or suggest that its fiber Bragg gratings having different wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 are a chirped Bragg grating etalon, as claimed herein. Kringlebotn's fiber Bragg gratings having different wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 are not a pair of identical fiber Bragg gratings as the term is known and used in the art.[4] Moreover, Kringlebotn does not teach or suggest

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[4] It is respectfully submitted that a person skilled in the art would appreciate that an etalon configuration has two identical Bragg gratings (i.e. having identical wavelengths) in a series in an optical fiber. In operation, optical light having the wavelength of the Bragg grating pair reflects back and forth between the identical Bragg grating pair. Enclosed is page 261 (Exhibit A) from "Fiber Bragg Gratings", by Othonos et al, which defines an etalon.

that its fiber Bragg gratings respond to the broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of the optical reference signals, as claimed herein. Clearly, the graph in Figure 1 has a time based output showing the different fiber Bragg grating wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 over different times. Finally, Kringlebotn neither recognizes nor suggests a solution to the problem related to using broadband fiber Bragg grating pairs for providing precise reference signals, which is the problem being addressed and solved by the claimed invention. This is no surprise since the whole thrust of Kringlebotn's disclosure relates to a measuring device.

The reasoning on page 2 of the Final Rejection recognizes that Kringlebotn does not teach or suggest either the use of an etalon or a chirped Bragg grating etalon as these terms are known and used in the art. In order to make up for this deficiency, the reasoning on pages 2-3 of the Final Rejection is pointing to Farhadiroushan to fill the gaps.

However, in summary, it is respectfully submitted that Farhadiroushan does not suggest the use of a chirped Bragg grating etalon in combination with a broadband optical source to solve the problem being address by the inventors. Further, Farhadiroushan also does not suggest the use of a chirped Bragg grating etalon in combination with a broadband optical source to provide a precise set of optical reference signals, especially

having a series of peaks covering most of a source spectral width of the broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20.

For example, Farhadiroushan discloses an optical sensor system having a series of sensing interferometers 10, each with a respective specific wavelength λ_1, λ_2, ..., λ_n. Each sensing interferometers 10 is formed by an in-line fiber Bragg grating pair that provide a single separate wavelength of interest. The reasoning in the Final Rejection, page 3, paragraph 1, clearly recognizes that the sensing interferometers 10 are not formed from chirped Bragg gratings, as claimed herein.

It is respectfully submitted that Farhadiroushan merely discloses a sensing device, and neither recognizes problems related to designing an optical system for providing a set of optical reference signals, nor provides suggestions about solutions related to such optical system designs for providing a set of optical reference signals, including the use of a chirped Bragg grating etalon to solve the "broadband grating" problem being addressed by the instant inventors for providing the same. In view of this, it is not clear on the record as a whole why one of ordinary skill would be motivated to even look to Farhadiroushan's teaching related to a sensing device to solve

the problem related to providing a set of reference signals like that being addressed by the instant inventors.

The Federal Circuit has clearly announced that, when an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the cited references. *Winner International Royalty Corp. v. Wang*, 202 F.3d 1340, 1348, 53 USPQ 2d 1850, 1585 (Fed. Cir.) cert. denied, 530 US 1238 (2000). The Federal Circuit further instructs that "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Fritch*, 972 F.2d 1260, 1266 Note.14 23 USPQ 2d 1780, 1783-84 N.14 (Fed. Cir. 1992) *citing In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). It is further established that "such a suggestion may come from the nature of the problem to be solved, leading inventors to look to references relating to possible solutions to the problem." *Pro-Mold & Toolco v. Great Lakes Plastics, Inc.*, 75 F.3d 1568-1573, 37 USPQ 2d 1626, 1630 (Fed. Cir. 1996), *citing In re Rinehart*, 531 F.2d 1048-1054, 189 USPQ 143, 149 (CCPA 1976) considering the problem to be solved in a determination of obviousness. The Federal Circuit reasons in *Para-Ordnance Mfg. v. SGS Importers International Inc.*, 73 F.3d, 1085, 1088-89, 37 USPQ 2d 1237-1239-40 (Fed. Cir. 1995), *cert. denied*, 519 US 822 (1996) for the determination of obviousness,

that the Court must answer whether one of ordinary skill in the art who sets out to solve the problem and who had before him in his workshop the prior art, would have been reasonably expected to use the solution that is claimed by the Appellant. However, "[o]bviousness may not be established using hindsight or in view of the teachings or suggestion of the invention". In addition, the Federal Circuit requires the Patent and Trademark Office to make specific findings on a suggestion to combine prior art references. *In re Dembiczak*, 175 F.3d 994, 1000-01, 50 USPQ 2d 1614, 1617-19 (Fed. Cir. 1999). "The combination of elements from non-analogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a *prima facie* case of obviousness." *Oetiker*, 977 F.2d at 1445, 24 USPQ 2d at 1446.

It is respectfully submitted that the proposed combination involving both a combination and substitution/modification is not proper under the case law announced by the Federal Circuit, because nothing in either cited reference, or anything else on the record as a whole for that matter, suggests either to make such a combination then a subsequent substitution/modification, or a reason why one of ordinary skill in the art would be motivated to do the same to solve the problem being addressed by the instant inventors. In view of this, the Examiner has failed to establish a *prima facie* case of unpatentability with respect

to all of these claims and, in particular, with respect to claims 1 and 20.

For instance, in the proposed combination a single one of the multiplicity of Farhadiroushan's non-chirped inline fiber Bragg grating pairs from the sensing interferometers 10 is being substituted for a single one of the multiplicity of fiber Bragg gratings 6 shown in Figure 1 of Kringlebotn. (The remaining multiplicity of fiber Bragg gratings 6 shown in Figure 1 of Kringlebotn are apparently not being used.) However, nothing in either cited reference suggests either to make such a first combination, or a reason why one of ordinary skill in the art would be motivated to make the same to solve the problem being addressed by the instant inventors. Further, clearly this proposed combination does not result in the claimed invention.

Because of this, in the proposed combination a single chirped Bragg grating etalon is next being substituted for Farhadiroushan's single non-chirped inline fiber Bragg grating pair in order to provide the claimed precise set of optical reference signals. However, for reasons set forth in the patent application on pages 1-2, the use of a chirped Bragg grating etalon configuration in the manner recited in the claimed invention provides an important contribution to the state of the art, the need or provision of which not recognized by the prior art and thus would not be obvious to one of ordinary skill in the art. For example, pages 1-2 of the patent application set forth

the problem in the art being addressed by the inventors of the claimed invention. In summary, the use of an etalon formed by broadband fiber Bragg grating pairs as shown in Figure 1 of the patent application results in a very limited set of resonant frequencies, as described in the patent application on page 2, line 20, through page 3, line 3. For example, if a resonant optical frequency is outside a very limited region, the light will pass through the fiber Bragg grating etalon cavity unaffected. For a set of reference optical frequencies, the unaffected light is most undesirable and would merely result in the provision of a very limited spectrum of optical reference signals. The use of a multiplicity of etalons formed from a series of broadband fiber Bragg grating pairs in order to overcome this problem raises a whole different set of problems, including issues related to the differing temperature sensitivities of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs.

The inventors first recognized this problem in the art and provided a solution to the same. To solve this problem, the inventors designed an optical system featuring a chirped Bragg grating etalon that responds to a broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. The precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the

broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20.

In effect, the whole thrust of the claimed invention is to use a broadband source in combination with a single chirped Bragg grating etalon in order to provide a precise set of optical reference signals having a broad spectrum of frequencies of interest. As a person skilled in the art would appreciate, the use of the chirped Bragg grating etalon to provide the desired series of peaks covering most of the source spectral width of the broadband source substantially eliminates the differing temperature sensitivities problem that might otherwise occur with the use of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs like that of the prior art shown in Figure 1 of the patent application.

It is respectfully submitted that none of the cited prior art references, or any other prior art on the record, either recognizes the aforementioned problem in the art, or even remotely suggests a solution thereto, especially the use of a Bragg grating chirped etalon to solve the same. For all these reasons, the prior art does not teach or suggest the further substitution of chirped bragg gratings in place of the pair of FBGs shown and described in <u>Farhadiroushan</u> so as to form the

chirped fiber Bragg grating etalon configuration, as claimed herein.

In conclusion, in the absence of that shown and described in the instant patent application, nothing in the cited references suggests either to make such a second substitution/modification, or a reason why one of ordinary skill in the art would be motivated to do the same to solve the problem being addressed by the instant inventors. For all these reasons, it is respectfully submitted that the proposed combination and substitution/modification is not proper under the Patent laws and smacks of hindsight reconstruction after the Patent Office has had the benefit of reading the instant patent application.

Reply to Points Made
in the Reasoning in the Final Rejection

The following is a reply to some points raised in the reasoning in the Final Rejection:

1) The Reasoning on Page 2, Paragraph 3

The reasoning in the Final Rejection, page 2, paragraph 3, recognizes that Kringlebotn discloses a wavelength measurement device for measuring Bragg grating wavelengths of several multiplexed FBGs having individual fiber Bragg gratings 6 with respective wavelengths λ_1, λ_2, λ_3 and an individual reference grating 5 with a wavelength λ, as shown in Figure 1. When

describing the embodiment shown in Figure 1, Kringlebotn, column 4, lines 49-50, states that:

> "The main part of the light is passed onto the FBGs 6, including '**at least one FBG 5**' with a known wavelength, providing an accurate wavelength reference, via another directional coupler 4." [Bold emphasis provided][5]

The reasoning points to this sentence together with the Abstract in Kringlebotn and states that:

> "This comment **still leaves doubt as to** whether each of the multiple Bragg gratings in an etalon structure would actually have the same known wavelength." [Bold emphasis provided][6]

Foremost, it is respectfully submitted that the meaning of this sentence is unclear to the undersigned attorney. Clearly, Kringlebotn does not disclose etalon structures. Moreover, it is respectfully submitted that a person skilled in the art would appreciate that each multiple Bragg grating in an etalon structure would actually have the same known wavelength. For instance, as remarked in Applicants' December 5th Amendment, a person skilled in the art would appreciate that an etalon configuration has two identical Bragg gratings (i.e. having identical wavelengths) in a series in an optical fiber. In operation, optical light having the wavelength of the Bragg grating pair reflects back and forth between the identical Bragg grating pair. (See Page 261 (Exhibit A) from "Fiber Bragg

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[5] Reference is also made to Kringlebotn's Abstract.

[6] A similar variation of this argument is being repeated in the Final Rejection on page 4, paragraph 2.

Gratings", by Othonos et al, which defines an etalon structure.) In view of this, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and in the Abstract, do not raise or leave any doubt in relation to the structural configuration of an etalon, which Kringlebotn clearly does not teach or suggest.

Moreover, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and in the Abstract, is being misinterpreted and/or misapplied, based on the fact that the "at least one" language is being incorrectly relied on to support the position that this language would somehow motivate one of ordinary skill in the art to look to Farhadiroushan to make up for the deficiency in teaching of Kringlebotn so as to try to substitute/modify two FBGs having identical wavelengths from Farhadiroushan for one of Kringlebotn's individual fiber Bragg gratings so as to form an etalon configuration. However, Kringlebotn's "at least one" language is clearly describing the FBG 5 in Figure 1 of Kringlebotn, which must be interpreted consistent with that shown in Figure 5, where the "at least one FBG 5" is shown and described as a pair of separate reference FBGs 5a, 5b having completely different reference wavelengths 1.55 and 1.3 microns. See Kringlebotn, the paragraph bridging columns 5-6. Clearly, Kringlebotn's pair of separate reference FBGs 5a, 5b in Figure 5 having the completely different reference wavelengths 1.55 and 1.3 microns neither individually nor

together form an etalon configuration. Moreover, Kringlebotn's pair of separate reference FBGs 5a, 5b in Figure 5 having the completely different reference wavelengths 1.55 and 1.3 microns is not even remotely suggestive of the formation of an etalon configuration. In view of this, it is respectfully submitted that a person skilled in the art would appreciate that Kringlebotn's statement on column 4, lines 49-50, and in the Abstract, leaves no doubt that Kringlebotn's two or more Bragg gratings 5a, 5b have different known wavelengths, so as not to form, and/or so as not to be suggestive of the formation of, an etalon having FBGs with identical wavelengths. For these reasons, it is respectfully submitted that Kringlebotn's statement on column 4, lines 49-50, and in the Abstract, cannot be interpreted or applied to support the position that the "at least one" language would motivate one of ordinary skill in the art to look to Farhadiroushan to make up for the deficiency in the teaching of Kringlebotn so as to try to substitute/modify two FBGs having identical wavelengths in Farhadiroushan for one of Kringlebotn's individual fiber Bragg gratings so as to form an etalon configuration, as claimed. **In fact, quite to the contrary, the subject matter shown and described in relation to Kringlebotn's Figure 5 expressly teaches away from using pairs of FBGs having identical wavelengths such as that taught by Farhadiroushan when the subject matter of Figure 5 of Kringlebotn is properly interpreted and applied.**

2) The Reasoning in the Final Rejection, Page 2, Paragraph 5

The reasoning in the Final Rejection, page 2, paragraph 5, states that "it would have been obvious" to make the proposed combination and subsequent substitution/modification of Kringlebotn's optical measuring device and Farhadiroushan's sensing device based on an alleged need "to facilitate the passage of a spectrum of wavelengths through the etalon".

However, it is respectfully submitted that the same reasoning does not say why "it would be obvious", especially in relation to solving the problem being addressed by the instant inventors. For instance, nothing in the reasoning in the Final Rejection, page 2, or on the record as a whole in view of the points made above, suggests why one of ordinary skill in the art would be motivated first to combine features of Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device in order to make the claimed optical system for providing a precise set of reference signals. Moreover, after combining these two devices, nothing in the reasoning in the Final Rejection, page 2, or on the record as a whole, suggests why one of ordinary skill in the art would be motivated to use Farhadiroushan's single non-chirped inline fiber Bragg grating pair that is otherwise used to provide a single separate wavelength of interest in Farhadiroushan's optical sensing system, then further modify it into a chirped fiber Bragg grating etalon to instead provide a set of reference signals in

Kringlebotn's device for measurement of optical wavelengths. In contrast, the reasoning in the Final Rejection, page 2, paragraph 5, is basing the proposed initial combination and subsequent substitution/modification on some alleged need "to facilitate the passage of a spectrum of wavelengths through the etalon". It is respectfully submitted that this reasoning is based on nothing more than hindsight reconstruction after the Patent Office has had the benefit of reading applicants' patent application. Clearly, the reasoning does not point to anything on the record to motivate one of ordinary skill in the art to satisfy such a so-called need in the prior art. For all these reasons discussed above, it is respectfully submitted that neither cited reference, nor anything else on the record as a whole, provides motivation for the proposed combination and subsequent substitution/modification, or makes up for this deficiency in the reasoning in the Final Rejection, page 2, paragraph 5.

3) The Reasoning on Page 4, Paragraph 2

In contrast to the reasoning on page 4, paragraph 2, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, do not provide a motivation for modifying Kringlebotn's single reference grating 5 depicted in Figure 1 when the "at least one FBG" language is interpreted consistent with that shown and described in Kringlebotn as a whole, consistent with that discussed above.

4) The Reasoning on Page 4, Paragraph 3

The reasoning on page 4, paragraph 3, states that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, provides so-called motivation to "to turn" Farhadiroushan.

However, in contrast to the reasoning on page 4, paragraph 3, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, do not provide the motivation "to turn" Farhadiroushan's non-chirped FBG as a basis to justify the proposed combination for the reasons discussed above. Moreover, the proposed combination without some further substitution/modification clearly does not result in the claimed invention.

5) The Reasoning on Page 5, Paragraph 1

The reasoning on page 5, paragraph 1, cites Galvanauskas et al. (United States Patent No. 5,499,134) for disclosing chirped Bragg gratings and points to its Abstract, lines 5-8, which describes the advantages of using the same, including "compactness, robustness, and system efficiency."

However, it is respectfully submitted that nothing in Galvanauskas et al. suggests to modify Farhadiroushan's single non-chirped inline fiber Bragg grating pair into a chirped grating pair in order to provide a set of reference signals, as claimed herein, or to solve the problem being addressed by the

inventors. It is respectfully submitted that, while certain advantages of using chirped gratings are known in the art, the real issue is what would motivate one of ordinary skill in the art to make such a substitution, after first combining Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device, in order to make the claimed optical system for providing a precise set of reference signals, as claimed herein. It is respectfully submitted that there is no such suggestion to do so on the record.

Dependent Claims 2-15

Claims 2-15 and 20 depend from claim 1, contain all the limitations therein, and are deemed patentable over the cited prior art for the reasons set forth above.

Claims 16-19

For substantially similar reasons, claims 16-19 are deemed patentable over the proposed combination.

Conclusion

In view of this, it is respectfully submitted that the reasoning in the rejection of these claims is in error, and should be reversed.

Respectfully submitted,

William J. Barber
Attorney for Applicants
Registration No. 32,720

WJB/dap
February 10, 2004
Enclosures: Exhibit A

IX. APPENDIX

The following claims are pending in the patent application:

1. An optical system, comprising:

a broadband source for providing a broadband optical signal; and

a chirped Bragg grating etalon, responsive to the broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals.

2. An optical system according to claim 1, wherein the chirped Bragg grating etalon includes a pair of chirped Bragg gratings.

3. An optical system according to claim 2, wherein the precise set of the optical reference signals is determined by the spacing of the chirped Bragg gratings of the chirped Bragg grating etalon.

4. An optical system according to claim 1, wherein the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broad optical source signal with the power at the beginning and end of the spectrum passed unaffected by the chirped Bragg grating etalon due to the limited bandwidth thereof.

5. An optical system according to claim 1, wherein the optical system further comprises an optical filter that responds to the chirped Bragg grating etalon optical signal, for providing an optical filter signal having the precise set of the optical reference signals.

6. An optical system according to claim 5, wherein the optical filter includes an optical bandpass filter.

7. An optical system according to claim 5, wherein the optical filter includes an additional Bragg grating.

8. An optical system according to claim 5, wherein the optical filter includes a long-period Bragg grating.

9. An optical system according to claim 5, wherein the optical filter includes a selective dielectric filter.

10. An optical system according to claim 9, wherein the selective dielectric filter is a Bragg grating.

11. An optical system according to claim 1, wherein the optical system further comprises an optical bandpass filter that responds to the chirped Bragg grating etalon optical signal, for providing an optical bandpass filter signal.

12. The optical system according to claim 1, further comprising:

an optical filter, responsive to the chirped Bragg grating etalon optical signal, for providing at least a portion of the precise set of the optical reference signals to an output port.

13. The optical system according to claim 12, further comprising:

an optical directional device for directing the chirped Bragg grating etalon optical signal to the optical filter, and directing the at least a portion of the precise set of the optical reference signals to the output port.

14. The optical system according to claim 13, wherein the optical directional device includes one of an optical circulator and an optical coupler.

15. The optical system according to claim 12, wherein the optical filter includes a Bragg grating filter for reflecting the at least a portion of the precise set of the optical reference signals to an output port.

16. An optical source, comprising:

a broad band source that provides a broadband optical signal; and

an etalon including an optical waveguide having a pair of chirped Bragg gratings disposed therein, wherein the pair of chirped Bragg gratings are optically spaced a predetermined distance to provide a desired filter profile.

17. An optical source according to claim 16, wherein the desired filter profile includes a precise set of optical reference signals.

18. An optical source according to claim 17, wherein the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source.

19. An optical source according to claim 18, wherein the broadband source has a spectrum and the power at the beginning and end of the spectrum is passed substantially unaffected by the etalon.

20. An optical source according to claim 1, wherein

the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source; and

the broadband source has a spectrum and the power at the beginning and end of the spectrum is passed substantially unaffected by the chirped Bragg grating etalon.

Serial No.: 09/703,823

Brag

Fiber Bragg Gratings

Fundamentals and Applications in Telecommunications and Sensing

Andreas Othonos
Kyriacos Kalli

Artech House
Boston • London

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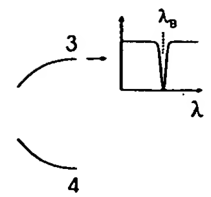

ɪroduced by the sequential
ɔt grating fringe patterns.
amplitude δn, with periods
: the following form:

(6.21)

d $\Lambda_b = 2\Lambda_1\Lambda_2/(\Lambda_1 - \Lambda_2)$. The
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:he fabrication of the moiré
ngs is accomplished either
ıg the writing wavelength
e <0.1 nm with associated
ɔy Zhang et al. [89] that the
roadening of the stopband.
r band-pass and stop-band
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l-pass filters and, as in the
:ion filters within a narrow
e for most practical WDM
y the phase shift on broad
a result, a highly efficient

in-fiber band-pass filter with arbitrary band-pass/stop-band combination can be successfully produced. This may be achieved either using UV post-fabrication techniques [99] or with a phase mask. Agrawal et al. [92] presented theoretical results on the insertion of multiple phase shifts (three π-phase-shift) equidistant along a fiber grating, resulting in three transmission peaks inside the stopband. As a further improvement to the operation of such devices as a band-pass filter, theoretical and experimental results on the introduction to a fiber Bragg grating of two π-phase-shifts located at optimized positions have been reported [100]. Although giving a wider and flattened band-pass peak, compared with the singly phase-shifted grating, the stop-band depth was not high enough for band-pass filter. The insertion of a third phase shift has been reported [101] giving a more rectangular band-pass shape while the increased phase-shift number allowed tailoring this rectangular spectral shape. Band-pass peaks with negligible ripples at the top (<0.01 dB) have been achieved through the optimization of distances between the phase shifts along the grating. These band-pass filters should find useful applications as noise filters or channel selectors in WDM systems.

6.5.6 Fabry-Perot Etalon Filters

Placing two identical Bragg gratings in series on a single-mode fiber results in a Fabry-Perot etalon within the fiber core. With the advancements in the inscription of Bragg gratings in optical fiber it is now possible to obtain etalons with finesse as high as several thousands. A simple filter application of the Fabry-Perot consists of an optical circulator and another fiber grating [102]. The input signal is filtered with a Fabry-Perot (grating pair) and directed forward to the fiber grating by an optical circulator. The reflected signal from the fiber Bragg grating is then redirected to the output port by the circulator. Although narrowband Bragg grating Fabry-Perot filters have been reported with very high finesse, for applications in short-pulse lasers and wideband communication systems, a response over several nanometers or more may be required with a wide variety of free spectral ranges needed. One technique to accomplish this is to use linear chirped gratings instead of constant period Bragg gratings [103]. Town et al. demonstrated this approach using a resonator formed with two linearly chirped gratings having reflectivities exceeding 50% over a 150-nm spectral width. The gratings in each pair were chirped in the same direction along the fiber axis. For lower vales of the free spectral range, the gratings were spatially separated; for higher values they were partially overlapped. This arrangement produced a resonator operating over a wavelength span exceeding 150 nm with a free spectral range value in the range 0.09–11.27 nm. These types of structures have been used to demonstrate CW multiwavelength operation of erbium-doped fiber lasers [9].

6.5.7 Comb and Superstructure Filters

The ability to permanently change the index of refraction in an optical fiber has proven to be extremely useful in the area of telecommunications and, in particular, in constructing

PATENT
File No.: 712-002-104/CC-0166

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Re application of: Michael A. Davis et al.

Serial No.: 09/703,823 : Examiner: Michael A. Lyons

Filed: November 1, 2000 : Group Art Unit: 2877

For: OPTICAL SYSTEM FEATURING CHIRPED BRAGG GRATING ETALON FOR PROVIDING PRECISE REFERENCE WAVELENGTHS

MAIL STOP APPEAL BRIEFS &NDASH; PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

BRIEF FOR APPELLANTS

Sir:

This is an appeal from an Official Action mailed August 7, 2003, made final, including an Advisory Action mailed October 28, 2003.[1]

A Notice of Appeal was mailed on December 8, 2003 with a return receipt postcard. The Patent Office stamped and mailed the return receipt postcard back to applicants on December 10, 2003.

This Brief is being filed in triplicate with a fee in the amount of $330.00 in accordance with 37 CFR §1.17(c).

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[1] I hereby certify that this correspondence is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner for Patents, Alexandria, VA 22313-1450.

Debra A. Pongetti
Debra A. Pongetti

February 10, 2004
Date

I. THE REAL PARTY IN INTEREST

The real party in interest is CiDRA Corporation, of Wallingford, Connecticut, a corporation of the State of Delaware, doing business at 50 Barnes Park North, Wallingford, CT 06492.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

III. STATUS OF CLAIMS

Independent claims 1 - 20 are pending, stand rejected, and are being appealed.

IV. STATUS OF AMENDMENTS

No amendment was filed subsequent to the August 7th final rejection.

V. SUMMARY OF THE INVENTION

1. The Problem In The Art

Pages 1-2 of the patent application set forth the problem in the art being addressed by the claimed invention. In summary, the use of an etalon formed by broadband fiber Bragg grating pairs as shown in Figure 1 of the patent application results in a very limited set of resonant frequencies, as described in the patent application on page 2, line 20, through page 3, line 3. For example, if a resonant optical frequency is outside a very limited region, the light will pass through the fiber Bragg grating etalon cavity unaffected. For a set of reference optical frequencies, the unaffected light is most undesirable and would merely result in the provision of a very limited spectrum of optical reference signals. The use of a multiplicity of etalons formed from a series of broadband fiber Bragg grating pairs in order to overcome this problem raises a whole different set of problems, including issues related to the differing temperature sensitivities of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs.

2. The Claimed Solution

The inventors recognized the aforementioned problem in the art and provided a solution to the same. To solve this problem, the inventors designed an optical system featuring a chirped Bragg grating etalon that responds to the broadband optical

signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. The precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20 (See also dependent claim 4).

In effect, the whole thrust of the claimed invention is to use a broadband source in combination with a chirped Bragg grating etalon in order to provide a precise set of optical reference signals having a broad spectrum of frequencies of interest. As a person skilled in the art would appreciate, the use of the chirped Bragg grating etalon to provide the desired series of peaks covering most of the source spectral width of the broadband source substantially eliminates the differing temperature sensitivities problem that might otherwise occur with the use of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs like that of the prior art shown in Figure 1 of the patent application.

VI. ISSUE

The following issue will be addressed in the Argument:

The non-obviousness of claims 1-20 over Kringlebotn (United States Patent No. 6,097,487) in view of Farhadiroushan (United States Patent No. 5,754,293).[2]

VII. GROUPING OF THE CLAIMS

Claims 1, 4 and 20 are argued separately, and claims 2-3 and 5-19 stand or fall in relation to claim 1.

VIII. ARGUMENTS

Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kringlebotn (United States Patent No. 6,097,487) in view of Farhadiroushan (United States Patent No. 5,754,293).[3]

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[2] The proposed combination also effectively include Galvanauskas et al. (United States Patent No. 5,499,134), which is being cited and relied on for disclosing chirped Bragg gratings.

[3] See footnote 2 re Galvanauskas et al..

The Traversal

It is respectfully submitted that the proposed combination of Kringlebotn in view of Farhadiroushan does not teach or suggest an optical system featuring a chirped Bragg grating etalon that responds to a broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. Moreover, it is respectfully submitted that the prior art does not suggest why one of ordinary skill in the art would be motivated first to combine features of Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device, then further modify the proposed combination by substituting Galvanauskas et al.' chirped Bragg gratings for Farhadiroushan's non-chirped inline fiber Bragg grating pairs, in order to end up with the claimed optical system for providing a precise set of reference signals, especially to solve the problem in the art being addressed by the inventors related to the use of broadband fiber Bragg grating pairs for providing such precise reference signals. None of the cited references even recognize the problem being solved by the inventors or suggest a solution thereto.

In particular, Kringlebotn discloses a wavelength measurement device for measuring Bragg grating wavelengths of several multiplexed FBGs, as described in column 4, line 37, to column 5, line 9. The wavelength measurement device includes a

broadband source 1 and tunable F-P filter 2 for providing a tunable broadband signal to a directional coupler 4 having two optical fibers attached thereto. One optical fiber has fiber Bragg gratings 6 having wavelengths λ_1, λ_2, λ_3, while the other optical fiber has at least one fiber Bragg grating 5 with a known wavelength having wavelengths λ_{ref}, and other fiber Bragg gratings λ_4, λ_5. In operation, the reflected light from the FBGs, occurring in time when the wavelength of the narrowband filter source light matches the Bragg wavelengths of the FBGs, is directed through a directional coupler 4 onto a detector 7 which converts the optical signal to an electrical pulse train as illustrated, with each pulse representing the individual Bragg wavelengths of the FBGs with one pulse representing λ_{ref}.

It is respectfully submitted that Kringlebotn does not teach or suggest that its fiber Bragg gratings having different wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 are a chirped Bragg grating etalon, as claimed herein. Kringlebotn's fiber Bragg gratings having different wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 are not a pair of identical fiber Bragg gratings as the term is known and used in the art.[4] Moreover, Kringlebotn does not teach or suggest

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[4] It is respectfully submitted that a person skilled in the art would appreciate that an etalon configuration has two identical Bragg gratings (i.e. having identical wavelengths) in a series in an optical fiber. In operation, optical light having the wavelength of the Bragg grating pair reflects back and forth between the identical Bragg grating pair. Enclosed is page 261 (Exhibit A) from "Fiber Bragg Gratings", by Othonos et al, which defines an etalon.

that its fiber Bragg gratings respond to the broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of the optical reference signals, as claimed herein. Clearly, the graph in Figure 1 has a time based output showing the different fiber Bragg grating wavelengths λ_1, λ_2, λ_3, λ_{ref}, λ_4, λ_5 over different times. Finally, Kringlebotn neither recognizes nor suggests a solution to the problem related to using broadband fiber Bragg grating pairs for providing precise reference signals, which is the problem being addressed and solved by the claimed invention. This is no surprise since the whole thrust of Kringlebotn's disclosure relates to a measuring device.

The reasoning on page 2 of the Final Rejection recognizes that Kringlebotn does not teach or suggest either the use of an etalon or a chirped Bragg grating etalon as these terms are known and used in the art. In order to make up for this deficiency, the reasoning on pages 2-3 of the Final Rejection is pointing to Farhadiroushan to fill the gaps.

However, in summary, it is respectfully submitted that Farhadiroushan does not suggest the use of a chirped Bragg grating etalon in combination with a broadband optical source to solve the problem being address by the inventors. Further, Farhadiroushan also does not suggest the use of a chirped Bragg grating etalon in combination with a broadband optical source to provide a precise set of optical reference signals, especially

having a series of peaks covering most of a source spectral width of the broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20.

For example, Farhadiroushan discloses an optical sensor system having a series of sensing interferometers 10, each with a respective specific wavelength λ_1, λ_2, ..., λ_n. Each sensing interferometers 10 is formed by an in-line fiber Bragg grating pair that provide a single separate wavelength of interest. The reasoning in the Final Rejection, page 3, paragraph 1, clearly recognizes that the sensing interferometers 10 are not formed from chirped Bragg gratings, as claimed herein.

It is respectfully submitted that Farhadiroushan merely discloses a sensing device, and neither recognizes problems related to designing an optical system for providing a set of optical reference signals, nor provides suggestions about solutions related to such optical system designs for providing a set of optical reference signals, including the use of a chirped Bragg grating etalon to solve the "broadband grating" problem being addressed by the instant inventors for providing the same. In view of this, it is not clear on the record as a whole why one of ordinary skill would be motivated to even look to Farhadiroushan's teaching related to a sensing device to solve

the problem related to providing a set of reference signals like that being addressed by the instant inventors.

The Federal Circuit has clearly announced that, when an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the cited references. *Winner International Royalty Corp. v. Wang*, 202 F.3d 1340, 1348, 53 USPQ 2d 1850, 1585 (Fed. Cir.) cert. denied, 530 US 1238 (2000). The Federal Circuit further instructs that "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Fritch*, 972 F.2d 1260, 1266 Note.14 23 USPQ 2d 1780, 1783-84 N.14 (Fed. Cir. 1992) *citing In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984). It is further established that "such a suggestion may come from the nature of the problem to be solved, leading inventors to look to references relating to possible solutions to the problem." *Pro-Mold & Toolco v. Great Lakes Plastics, Inc.*, 75 F.3d 1568-1573, 37 USPQ 2d 1626, 1630 (Fed. Cir. 1996), *citing In re Rinehart*, 531 F.2d 1048-1054, 189 USPQ 143, 149 (CCPA 1976) considering the problem to be solved in a determination of obviousness. The Federal Circuit reasons in *Para-Ordnance Mfg. v. SGS Importers International Inc.*, 73 F.3d, 1085, 1088-89, 37 USPQ 2d 1237-1239-40 (Fed. Cir. 1995), *cert. denied*, 519 US 822 (1996) for the determination of obviousness,

that the Court must answer whether one of ordinary skill in the art who sets out to solve the problem and who had before him in his workshop the prior art, would have been reasonably expected to use the solution that is claimed by the Appellant. However, "[o]bviousness may not be established using hindsight or in view of the teachings or suggestion of the invention". In addition, the Federal Circuit requires the Patent and Trademark Office to make specific findings on a suggestion to combine prior art references. *In re Dembiczak*, 175 F.3d 994, 1000-01, 50 USPQ 2d 1614, 1617-19 (Fed. Cir. 1999). "The combination of elements from non-analogous sources, in a manner that reconstructs the applicant's invention only with the benefit of hindsight, is insufficient to present a *prima facie* case of obviousness." *Oetiker*, 977 F.2d at 1445, 24 USPQ 2d at 1446.

It is respectfully submitted that the proposed combination involving both a combination and substitution/modification is not proper under the case law announced by the Federal Circuit, because nothing in either cited reference, or anything else on the record as a whole for that matter, suggests either to make such a combination then a subsequent substitution/modification, or a reason why one of ordinary skill in the art would be motivated to do the same to solve the problem being addressed by the instant inventors. In view of this, the Examiner has failed to establish a *prima facie* case of unpatentability with respect

to all of these claims and, in particular, with respect to claims 1 and 20.

For instance, in the proposed combination a single one of the multiplicity of Farhadiroushan's non-chirped inline fiber Bragg grating pairs from the sensing interferometers 10 is being substituted for a single one of the multiplicity of fiber Bragg gratings 6 shown in Figure 1 of Kringlebotn. (The remaining multiplicity of fiber Bragg gratings 6 shown in Figure 1 of Kringlebotn are apparently not being used.) However, nothing in either cited reference suggests either to make such a first combination, or a reason why one of ordinary skill in the art would be motivated to make the same to solve the problem being addressed by the instant inventors. Further, clearly this proposed combination does not result in the claimed invention.

Because of this, in the proposed combination a single chirped Bragg grating etalon is next being substituted for Farhadiroushan's single non-chirped inline fiber Bragg grating pair in order to provide the claimed precise set of optical reference signals. However, for reasons set forth in the patent application on pages 1-2, the use of a chirped Bragg grating etalon configuration in the manner recited in the claimed invention provides an important contribution to the state of the art, the need or provision of which not recognized by the prior art and thus would not be obvious to one of ordinary skill in the art. For example, pages 1-2 of the patent application set forth

the problem in the art being addressed by the inventors of the claimed invention. In summary, the use of an etalon formed by broadband fiber Bragg grating pairs as shown in Figure 1 of the patent application results in a very limited set of resonant frequencies, as described in the patent application on page 2, line 20, through page 3, line 3. For example, if a resonant optical frequency is outside a very limited region, the light will pass through the fiber Bragg grating etalon cavity unaffected. For a set of reference optical frequencies, the unaffected light is most undesirable and would merely result in the provision of a very limited spectrum of optical reference signals. The use of a multiplicity of etalons formed from a series of broadband fiber Bragg grating pairs in order to overcome this problem raises a whole different set of problems, including issues related to the differing temperature sensitivities of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs.

The inventors first recognized this problem in the art and provided a solution to the same. To solve this problem, the inventors designed an optical system featuring a chirped Bragg grating etalon that responds to a broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals, as recited in claim 1. The precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the

broadband source with the power at the beginning and end of the spectrum of the broadband source passed substantially unaffected by the chirped Bragg grating etalon, as recited in dependent claim 20.

In effect, the whole thrust of the claimed invention is to use a broadband source in combination with a single chirped Bragg grating etalon in order to provide a precise set of optical reference signals having a broad spectrum of frequencies of interest. As a person skilled in the art would appreciate, the use of the chirped Bragg grating etalon to provide the desired series of peaks covering most of the source spectral width of the broadband source substantially eliminates the differing temperature sensitivities problem that might otherwise occur with the use of the multiplicity of etalons formed from the broadband fiber Bragg grating pairs like that of the prior art shown in Figure 1 of the patent application.

It is respectfully submitted that none of the cited prior art references, or any other prior art on the record, either recognizes the aforementioned problem in the art, or even remotely suggests a solution thereto, especially the use of a Bragg grating chirped etalon to solve the same. For all these reasons, the prior art does not teach or suggest the further substitution of chirped bragg gratings in place of the pair of FBGs shown and described in Farhadiroushan so as to form the

chirped fiber Bragg grating etalon configuration, as claimed herein.

In conclusion, in the absence of that shown and described in the instant patent application, nothing in the cited references suggests either to make such a second substitution/modification, or a reason why one of ordinary skill in the art would be motivated to do the same to solve the problem being addressed by the instant inventors. For all these reasons, it is respectfully submitted that the proposed combination and substitution/modification is not proper under the Patent laws and smacks of hindsight reconstruction after the Patent Office has had the benefit of reading the instant patent application.

Reply to Points Made
in the Reasoning in the Final Rejection

The following is a reply to some points raised in the reasoning in the Final Rejection:

1) The Reasoning on Page 2, Paragraph 3

The reasoning in the Final Rejection, page 2, paragraph 3, recognizes that Kringlebotn discloses a wavelength measurement device for measuring Bragg grating wavelengths of several multiplexed FBGs having individual fiber Bragg gratings 6 with respective wavelengths λ_1, λ_2, λ_3 and an individual reference grating 5 with a wavelength λ, as shown in Figure 1. When

describing the embodiment shown in Figure 1, Kringlebotn, column 4, lines 49-50, states that:

> "The main part of the light is passed onto the FBGs 6, including **'at least one FBG 5'** with a known wavelength, providing an accurate wavelength reference, via another directional coupler 4." [Bold emphasis provided][5]

The reasoning points to this sentence together with the Abstract in Kringlebotn and states that:

> "This comment **still leaves doubt as to** whether each of the multiple Bragg gratings in an etalon structure would actually have the same known wavelength." [Bold emphasis provided][6]

Foremost, it is respectfully submitted that the meaning of this sentence is unclear to the undersigned attorney. Clearly, Kringlebotn does not disclose etalon structures. Moreover, it is respectfully submitted that a person skilled in the art would appreciate that each multiple Bragg grating in an etalon structure would actually have the same known wavelength. For instance, as remarked in Applicants' December 5th Amendment, a person skilled in the art would appreciate that an etalon configuration has two identical Bragg gratings (i.e. having identical wavelengths) in a series in an optical fiber. In operation, optical light having the wavelength of the Bragg grating pair reflects back and forth between the identical Bragg grating pair. (See Page 261 (Exhibit A) from "Fiber Bragg

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[5] Reference is also made to Kringlebotn's Abstract.

[6] A similar variation of this argument is being repeated in the Final Rejection on page 4, paragraph 2.

Gratings", by Othonos et al, which defines an etalon structure.) In view of this, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and in the Abstract, do not raise or leave any doubt in relation to the structural configuration of an etalon, which Kringlebotn clearly does not teach or suggest.

Moreover, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and in the Abstract, is being misinterpreted and/or misapplied, based on the fact that the "at least one" language is being incorrectly relied on to support the position that this language would somehow motivate one of ordinary skill in the art to look to Farhadiroushan to make up for the deficiency in teaching of Kringlebotn so as to try to substitute/modify two FBGs having identical wavelengths from Farhadiroushan for one of Kringlebotn's individual fiber Bragg gratings so as to form an etalon configuration. However, Kringlebotn's "at least one" language is clearly describing the FBG 5 in Figure 1 of Kringlebotn, which must be interpreted consistent with that shown in Figure 5, where the "at least one FBG 5" is shown and described as a pair of separate reference FBGs 5a, 5b having completely different reference wavelengths 1.55 and 1.3 microns. See Kringlebotn, the paragraph bridging columns 5-6. Clearly, Kringlebotn's pair of separate reference FBGs 5a, 5b in Figure 5 having the completely different reference wavelengths 1.55 and 1.3 microns neither individually nor

together form an etalon configuration. Moreover, Kringlebotn's pair of separate reference FBGs 5a, 5b in Figure 5 having the completely different reference wavelengths 1.55 and 1.3 microns is not even remotely suggestive of the formation of an etalon configuration. In view of this, it is respectfully submitted that a person skilled in the art would appreciate that Kringlebotn's statement on column 4, lines 49-50, and in the Abstract, leaves no doubt that Kringlebotn's two or more Bragg gratings 5a, 5b have different known wavelengths, so as not to form, and/or so as not to be suggestive of the formation of, an etalon having FBGs with identical wavelengths. For these reasons, it is respectfully submitted that Kringlebotn's statement on column 4, lines 49-50, and in the Abstract, cannot be interpreted or applied to support the position that the "at least one" language would motivate one of ordinary skill in the art to look to Farhadiroushan to make up for the deficiency in the teaching of Kringlebotn so as to try to substitute/modify two FBGs having identical wavelengths in Farhadiroushan for one of Kringlebotn's individual fiber Bragg gratings so as to form an etalon configuration, as claimed. **In fact, quite to the contrary, the subject matter shown and described in relation to Kringlebotn's Figure 5 expressly teaches away from using pairs of FBGs having identical wavelengths such as that taught by Farhadiroushan when the subject matter of Figure 5 of Kringlebotn is properly interpreted and applied.**

2) The Reasoning in the Final Rejection, Page 2, Paragraph 5

The reasoning in the Final Rejection, page 2, paragraph 5, states that "it would have been obvious" to make the proposed combination and subsequent substitution/modification of Kringlebotn's optical measuring device and Farhadiroushan's sensing device based on an alleged need "to facilitate the passage of a spectrum of wavelengths through the etalon".

However, it is respectfully submitted that the same reasoning does not say why "it would be obvious", especially in relation to solving the problem being addressed by the instant inventors. For instance, nothing in the reasoning in the Final Rejection, page 2, or on the record as a whole in view of the points made above, suggests why one of ordinary skill in the art would be motivated first to combine features of Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device in order to make the claimed optical system for providing a precise set of reference signals. Moreover, after combining these two devices, nothing in the reasoning in the Final Rejection, page 2, or on the record as a whole, suggests why one of ordinary skill in the art would be motivated to use Farhadiroushan's single non-chirped inline fiber Bragg grating pair that is otherwise used to provide a single separate wavelength of interest in Farhadiroushan's optical sensing system, then further modify it into a chirped fiber Bragg grating etalon to instead provide a set of reference signals in

Kringlebotn's device for measurement of optical wavelengths. In contrast, the reasoning in the Final Rejection, page 2, paragraph 5, is basing the proposed initial combination and subsequent substitution/modification on some alleged need "to facilitate the passage of a spectrum of wavelengths through the etalon". It is respectfully submitted that this reasoning is based on nothing more than hindsight reconstruction after the Patent Office has had the benefit of reading applicants' patent application. Clearly, the reasoning does not point to anything on the record to motivate one of ordinary skill in the art to satisfy such a so-called need in the prior art. For all these reasons discussed above, it is respectfully submitted that neither cited reference, nor anything else on the record as a whole, provides motivation for the proposed combination and subsequent substitution/modification, or makes up for this deficiency in the reasoning in the Final Rejection, page 2, paragraph 5.

3) The Reasoning on Page 4, Paragraph 2

In contrast to the reasoning on page 4, paragraph 2, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, do not provide a motivation for modifying Kringlebotn's single reference grating 5 depicted in Figure 1 when the "at least one FBG" language is interpreted consistent with that shown and described in Kringlebotn as a whole, consistent with that discussed above.

4) The Reasoning on Page 4, Paragraph 3

The reasoning on page 4, paragraph 3, states that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, provides so-called motivation to "to turn" Farhadiroushan.

However, in contrast to the reasoning on page 4, paragraph 3, it is respectfully submitted that Kringlebotn's statement in column 4, lines 49-50, and the Abstract, do not provide the motivation "to turn" Farhadiroushan's non-chirped FBG as a basis to justify the proposed combination for the reasons discussed above. Moreover, the proposed combination without some further substitution/modification clearly does not result in the claimed invention.

5) The Reasoning on Page 5, Paragraph 1

The reasoning on page 5, paragraph 1, cites Galvanauskas et al. (United States Patent No. 5,499,134) for disclosing chirped Bragg gratings and points to its Abstract, lines 5-8, which describes the advantages of using the same, including "compactness, robustness, and system efficiency."

However, it is respectfully submitted that nothing in Galvanauskas et al. suggests to modify Farhadiroushan's single non-chirped inline fiber Bragg grating pair into a chirped grating pair in order to provide a set of reference signals, as claimed herein, or to solve the problem being addressed by the

inventors. It is respectfully submitted that, while certain advantages of using chirped gratings are known in the art, the real issue is what would motivate one of ordinary skill in the art to make such a substitution, after first combining Kringlebotn's optical measuring device with features of Farhadiroushan's sensing device, in order to make the claimed optical system for providing a precise set of reference signals, as claimed herein. It is respectfully submitted that there is no such suggestion to do so on the record.

Dependent Claims 2-15

Claims 2-15 and 20 depend from claim 1, contain all the limitations therein, and are deemed patentable over the cited prior art for the reasons set forth above.

Claims 16-19

For substantially similar reasons, claims 16-19 are deemed patentable over the proposed combination.

Conclusion

In view of this, it is respectfully submitted that the reasoning in the rejection of these claims is in error, and should be reversed.

Respectfully submitted,

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WJB/dap
February 10, 2004
Enclosures: Exhibit A

IX. APPENDIX

The following claims are pending in the patent application:

1. An optical system, comprising:

a broadband source for providing a broadband optical signal; and

a chirped Bragg grating etalon, responsive to the broadband optical signal, for providing a chirped Bragg grating etalon optical signal having a precise set of optical reference signals.

2. An optical system according to claim 1, wherein the chirped Bragg grating etalon includes a pair of chirped Bragg gratings.

3. An optical system according to claim 2, wherein the precise set of the optical reference signals is determined by the spacing of the chirped Bragg gratings of the chirped Bragg grating etalon.

4. An optical system according to claim 1, wherein the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broad optical source signal with the power at the beginning and end of the spectrum passed unaffected by the chirped Bragg grating etalon due to the limited bandwidth thereof.

5. An optical system according to claim 1, wherein the optical system further comprises an optical filter that responds to the chirped Bragg grating etalon optical signal, for providing an optical filter signal having the precise set of the optical reference signals.

6. An optical system according to claim 5, wherein the optical filter includes an optical bandpass filter.

7. An optical system according to claim 5, wherein the optical filter includes an additional Bragg grating.

8. An optical system according to claim 5, wherein the optical filter includes a long-period Bragg grating.

9. An optical system according to claim 5, wherein the optical filter includes a selective dielectric filter.

10. An optical system according to claim 9, wherein the selective dielectric filter is a Bragg grating.

11. An optical system according to claim 1, wherein the optical system further comprises an optical bandpass filter that responds to the chirped Bragg grating etalon optical signal, for providing an optical bandpass filter signal.

12. The optical system according to claim 1, further comprising:

an optical filter, responsive to the chirped Bragg grating etalon optical signal, for providing at least a portion of the precise set of the optical reference signals to an output port.

13. The optical system according to claim 12, further comprising:

an optical directional device for directing the chirped Bragg grating etalon optical signal to the optical filter, and directing the at least a portion of the precise set of the optical reference signals to the output port.

14. The optical system according to claim 13, wherein the optical directional device includes one of an optical circulator and an optical coupler.

15. The optical system according to claim 12, wherein the optical filter includes a Bragg grating filter for reflecting the at least a portion of the precise set of the optical reference signals to an output port.

16. An optical source, comprising:

a broad band source that provides a broadband optical signal; and

an etalon including an optical waveguide having a pair of chirped Bragg gratings disposed therein, wherein the pair of chirped Bragg gratings are optically spaced a predetermined distance to provide a desired filter profile.

17. An optical source according to claim 16, wherein the desired filter profile includes a precise set of optical reference signals.

18. An optical source according to claim 17, wherein the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source.

19. An optical source according to claim 18, wherein the broadband source has a spectrum and the power at the beginning and end of the spectrum is passed substantially unaffected by the etalon.

20. An optical source according to claim 1, wherein

the precise set of the optical reference signals includes a series of peaks covering most of a source spectral width of the broadband source; and

the broadband source has a spectrum and the power at the beginning and end of the spectrum is passed substantially unaffected by the chirped Bragg grating etalon.

Serial No.: 09/703,823

Brag

Fiber Bragg Gratings

Fundamentals and Applications in Telecommunications and Sensing

Andreas Othonos
Kyriacos Kalli

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Boston • London

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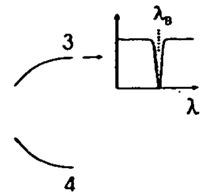

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in-fiber band-pass filter with arbitrary band-pass/stop-band combination can be successfully produced. This may be achieved either using UV post-fabrication techniques [99] or with a phase mask. Agrawal et al. [92] presented theoretical results on the insertion of multiple phase shifts (three π-phase-shift) equidistant along a fiber grating, resulting in three transmission peaks inside the stopband. As a further improvement to the operation of such devices as a band-pass filter, theoretical and experimental results on the introduction to a fiber Bragg grating of two π-phase-shifts located at optimized positions have been reported [100]. Although giving a wider and flattened band-pass peak, compared with the singly phase-shifted grating, the stop-band depth was not high enough for band-pass filter. The insertion of a third phase shift has been reported [101] giving a more rectangular band-pass shape while the increased phase-shift number allowed tailoring this rectangular spectral shape. Band-pass peaks with negligible ripples at the top (<0.01 dB) have been achieved through the optimization of distances between the phase shifts along the grating. These band-pass filters should find useful applications as noise filters or channel selectors in WDM systems.

6.5.6 Fabry-Perot Etalon Filters

Placing two identical Bragg gratings in series on a single-mode fiber results in a Fabry-Perot etalon within the fiber core. With the advancements in the inscription of Bragg gratings in optical fiber it is now possible to obtain etalons with finesse as high as several thousands. A simple filter application of the Fabry-Perot consists of an optical circulator and another fiber grating [102]. The input signal is filtered with a Fabry-Perot (grating pair) and directed forward to the fiber grating by an optical circulator. The reflected signal from the fiber Bragg grating is then redirected to the output port by the circulator. Although narrowband Bragg grating Fabry-Perot filters have been reported with very high finesse, for applications in short-pulse lasers and wideband communication systems, a response over several nanometers or more may be required with a wide variety of free spectral ranges needed. One technique to accomplish this is to use linear chirped gratings instead of constant period Bragg gratings [103]. Town et al. demonstrated this approach using a resonator formed with two linearly chirped gratings having reflectivities exceeding 50% over a 150-nm spectral width. The gratings in each pair were chirped in the same direction along the fiber axis. For lower vales of the free spectral range, the gratings were spatially separated; for higher values they were partially overlapped. This arrangement produced a resonator operating over a wavelength span exceeding 150 nm with a free spectral range value in the range 0.09–11.27 nm. These types of structures have been used to demonstrate CW multiwavelength operation of erbium-doped fiber lasers [9].

6.5.7 Comb and Superstructure Filters

The ability to permanently change the index of refraction in an optical fiber has proven to be extremely useful in the area of telecommunications and, in particular, in constructing